1. Optical observations

SN2008ha was monitored in photometry and spectroscopy using the following telescopes: the 3.58-m Telescopio Nazionale Galileo (TNG) equipped with Dolores, the 2.5-m Nordic Optical Telescope (NOT) with ALFOSC, and the 2.0-m Liverpool Telescope (LT) with RATCam, all located at the Roque de los Muchachos in La Palma (Canary Island, Spain). Additional data have been collected at the 1.82-m Copernico Telescope of the Asiago Observatory (Mt. Ekar, Asiago, Italy) , the 0.36-m Schmidt Telescope of the Begues Observatory (BO) in Barcelona (Spain), the 0.40m Schmidt Telescope of the Arguines Observatory (AO) in Segorbe (Spain), the 2.2m Telescope at the Calar Alto Observatory (Spain), and the 0.30-m Telescope of the Taurus Hill Observatory (THO) in Varkaus (Finland). Supplementary Table 1 reports the log of observations spanning two months after the discovery. In columns 1 and 2 the date and the Julian Day of the observations are given, in column 3 and 4 the telescope name and the set-up (respectively) used in the observations are reported, while in column 5 and 6 the V and R band magnitudes measured with the PSF-fitting technique and calibrated using Landolt fields[31]. Those were observed during two photometric nights (marked in the table with *). SN2008ha reached its maximum in the R band (17.2 ±0.3) on JD=2454787±2. Since there is no spectroscopic evidence of interstellar Na ID lines at the SN rest frame, we assume the host-galaxy extinction to be negligible. Hence, we applied reddening correction only for the Milky Way extinction, viz. E(B-V)= 0.076 (Ref. 32). Adopting a distance modulus of μ=31.55 mag (see Supplementary Table 2), this gives an absolute R-band magnitude at peak M_R= -14.5. Starting from the R light curve, we computed a pseudo-bolometric light curve.

Since the spectral energy distribution of SN2008ha is very similarity to that of SN2005hk, we used this object as a reference and add a bolometric correction to the R-band flux (taking also in to account the different time evolution of the two supernovae). Fitting the pseudo-bolometric light curve with a toy-model based on Arnett's equations (Ref. 18) (see Ref. 33 for details on the toy-model) we estimated for SN2008ha an ejected mass between 0.1 and 0.5 solar masses, a kinetic energy of 1-5 x 10^{49} erg, a nickel mass of 0.003-0.005 solar masses and an JD ~ 2454773 as explosion time. Even though these values should be confirmed by detailed models, such a small ejected mass is consistent with the fast luminosity and spectral evolution of SN2008ha, and makes the thermonuclear explosion of a degenerate white dwarf of 1.4 solar masses (i.e. a normal SNe Ia), very unlikely.

Supplementary Table 1: Photometric and spectroscopic observations of SN2008ha.

Date	JD	Telescope	Setup	V	R
Photometry					
2008-11-13	2454784.26	BO	Unfiltered	--	17.30 ± 0.30
2008-11-16	2454786.29	BO	Unfiltered	--	17.20 ± 0.20
2008-11-21	2454791.29	BO	Unfiltered	--	17.40 ±0.20
2008-11-26	2454797.29	BO	Unfiltered	--	18.15 ± 0.20
2008-11-27	2454798.46	Ekar	AFOSC-BVRI	18.86 ±0.15	18.36 ±0.12
2008-11-28	2454799.24	THO	Unfiltered	--	18.30 ±0.30
2008-11-28	2454799.37	TNG	DOLORES-Unfiltered	--	18.20 ±0.05
2008-12-06	2454807.37	NOT	ALFOSC-UBVRI	19.25 ±0.09	18.80 ±0.05
2008-12-11	2454812.27	BO	Unfiltered	--	19.03 ±0.40

2008-12-11	2454812.32	AO	Unfiltered	--	19.15 ±0.40
2008-12-11	2454812.36	LT	RATCAM+VR	19.54 ± 0.10	19.06 ±0.30
2008-12-12	2454813.27	BO	Unfiltered	--	19.00 ±0.40
2008-12-18	2454819.23	AO	Unfiltered	--	19.50 ±0.40
2008-12-18	2454819.25	LT	RATCAM+VR	19.94 ± 0.15	19.50 ± 0.40
2008-12-21*	2454822.39	TNG	DOLORES-VR	19.99 ± 0.05	19.60 ±0.20
2008-12-22	2454823.38	LT	RATCAM+VR	20.15 ±0.40	19.60 ±0.20
2008-12-27	2454828.25	THO	Unfiltered	--	< 19.5
2008-12-30*	2454831.39	CA	CAFOSC+BVRI	20.37 ±0.13	20.02 ±0.10
2009-01-01	2454833.18	THO	Unfiltered	--	<20.0
2009-01-19	2454851.38	TNG	DOLORES-VR	20.82 ± 0.4	20.49± 0.20
Spectroscopy					
2008-11-23	2454794.38	TNG	DOLORES-LRR		
2008-11-27	2454798.39	Ekar	AFOSC-GR4		
2008-11-28	2454799.38	TNG	DOLORES-LRB		
2008-12-06	2454807.42	NOT	ALFOSC-gm4		
2008-12-21	2454822.40	TNG	DOLORES-LRB/R		
2009-01-19	2454851.36	TNG	DOLORES-LRR		

2. The SN2002cx-like family

We found, in the literature, 7 supernovae which have been reported to be similar to SN2002cx (Refs. 6,15,21,22,23,34,28,35,36,37) and these are listed in Supplementary Table 2. One of them, SN2007J, was later re-classified as a peculiar helium-rich (SNIb) core-collapse SN, since He I features appeared later in the spectra[28] (see main manuscript).

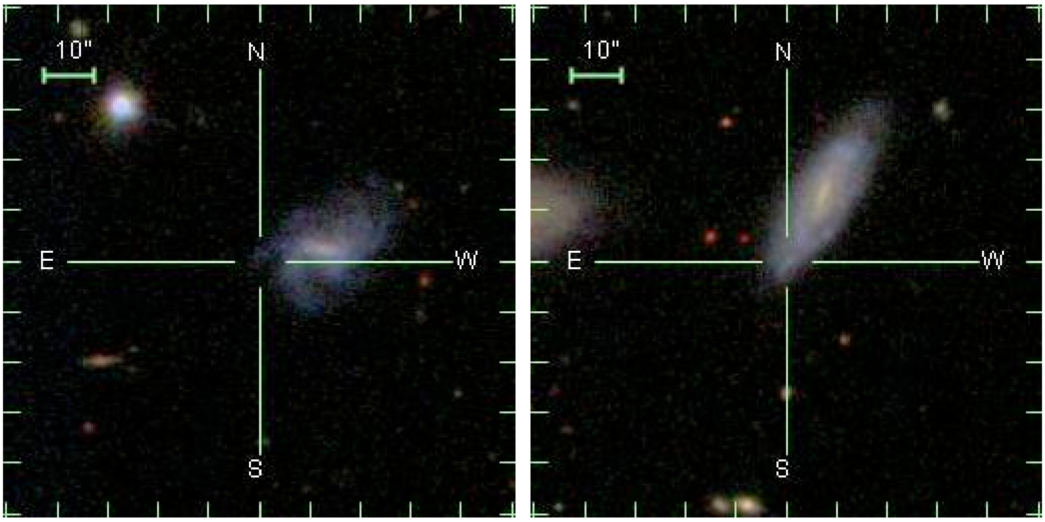
SN2007qd (another SN of this class) was quite similar to SN2008ha. It showed a photospheric velocity of ~2,600 km s^{-1} and was 1 magnitude fainter than SN2002cx (Ref. 34). Ref. 23 suggested, for SN2007qd, in the hypothesis of a thermonuclear explosion of 1.4 solar masses of ejecta, a W7 model[27] scaled down to an energy ~ 8 x10^{49} erg, which would result in a very slow evolution of the light curve. This confirms that the fast evolution of the light curve of SN2008ha is in disagreement with a thermonuclear explosion of 1.4 solar masses.

We also investigated the galaxy types of SN2002cx-like events (see Supplementary Table 2). The galaxy types have been collected from the NED (Ref. 38) and HyperLeda (Ref. 39) databases, with the exception of the hosts of SN2002cx and SN2007qd. Images of these 2 galaxies, from the SDSS DR7 (Ref. 40), are shown in Figure 1, and we estimate for them morphological types Sb/Sc and SBb/SBc respectively. The distance for SDSS J020932.74-005959.6 was taken from SDSS DR7. The galaxy absolute magnitude values M_B and M_g are from Hyperleda and SDSS DR7. The host galaxies are not particularly faint, suggesting that there is no evidence for dwarf hosts or low metallicity environments for the progenitor stars. In Figure 2, we compare the host galaxies morphology types of SN2002cx-like events with those of other SN types. All eight SNe have late-type host galaxies (Sb or later) (see Figure 4, and Table 2 of Supplementary Information). After the submission of our work, another paper on SN2008ha and SN2002cx-like events was submitted (Ref. 41). They consider a larger sample of 15 candidate SN2002cx-like events and find that one is hosted in an S0 galaxy (SN2008ge in NGC1527) and two others are hosted in Sa type spirals (SN2006hn and SN2008A). Remarkably, the galaxy morphology distribution of SN2002cx-like events resemble that of the star formation distribution of Ref. 42, with signature of star formation also in S0.

In our sample and in the sample of Ref 41, there is some evidence that the host galaxy distribution of SN2002cx-like objects is different from that of normal and under luminous thermonuclear explosion and is consistent with either all other CC SN classes and high-luminous 1991T-like thermonuclear SNe. However, the statistics in both our sample and the extended sample of Ref 41 are somewhat too small to draw firm conclusions from numerical statistical tests. The most we can say is that there is does appear to be a lack of SN2002cx-like objects in early-type galaxies and their distribution is not unlike core-collapse SNe.

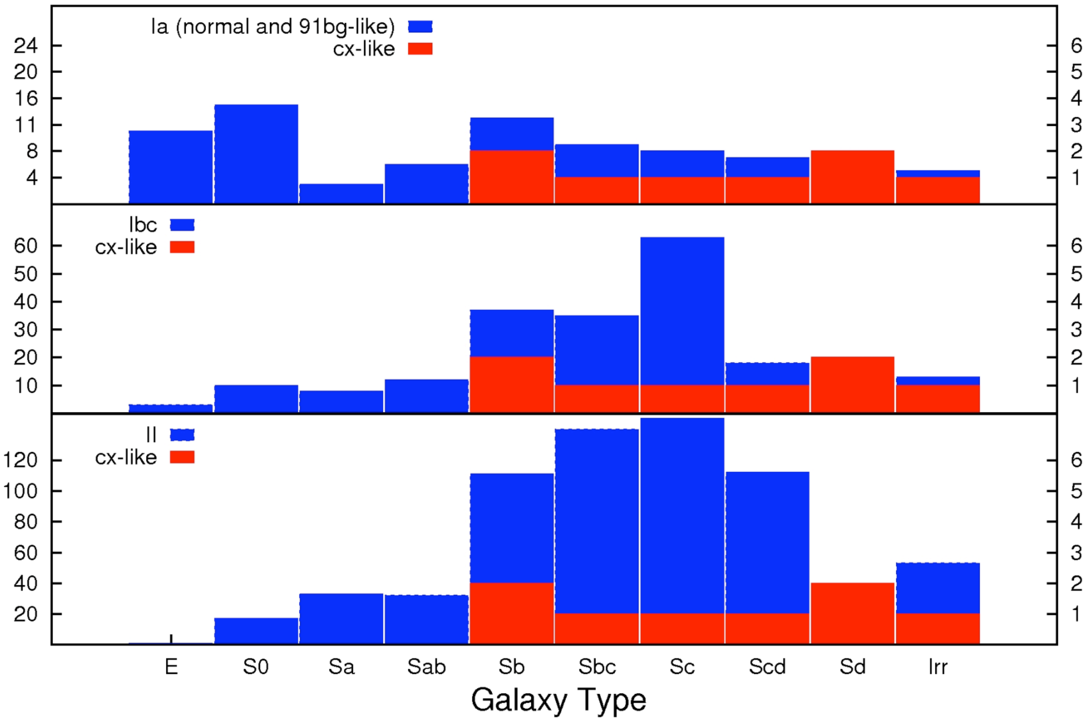
Supplementary Table 2: Host galaxies of SN2002cx-like events.

SN	Host Galaxy	Type	M_λ	Distance Modulo	Source
2002cx	CGCG 044-035	Sb/Sc	−19.7 (B)	35.02	HST archive image
2003gq	NGC7407	Sbc/Sc	−21.70 (B)	34.80	NED/Hyperleda
2005P	NGC5468	SAB(rs)cd/SABc	−20.3 (B)	33.01	NED/Hyperleda
2005cc	NGC5383	SBb (pec Sbrst)/Sb	−20.71 (B)	32.65	NED/Hyperleda
2005hk	UGC272	S(AB)(s)d/SABc	−19.42 (B)	33.65	NED/Hyperleda
2007J	UGC1778	SAdm/Sd	−20.24 (B)	34.27	NED/Hyperleda
2007qd	SDSS J020932.74	SBb or SBc	−19.7 (g)	36.12	SDSS
2008ha	UGC12682	Im/Irr	−18.14 (B)	31.55	NED/HyperLEDA

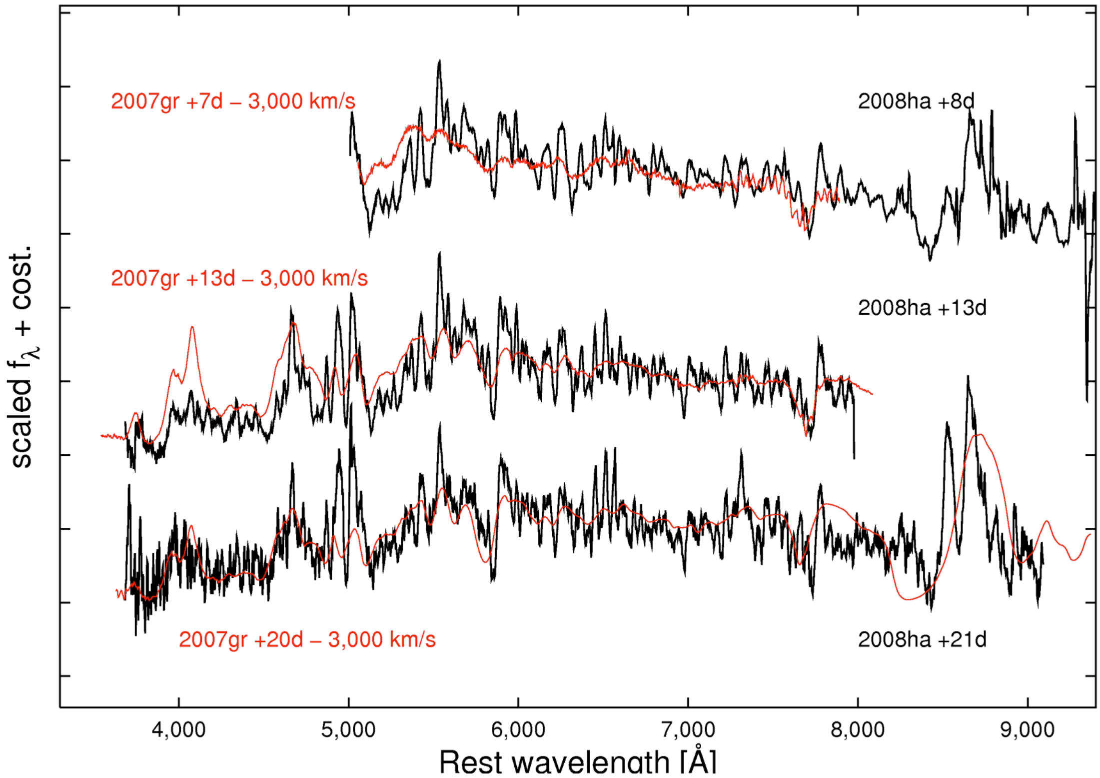


Supplementary Figure 1| Host galaxies of SN2007qd and SN2002cx.

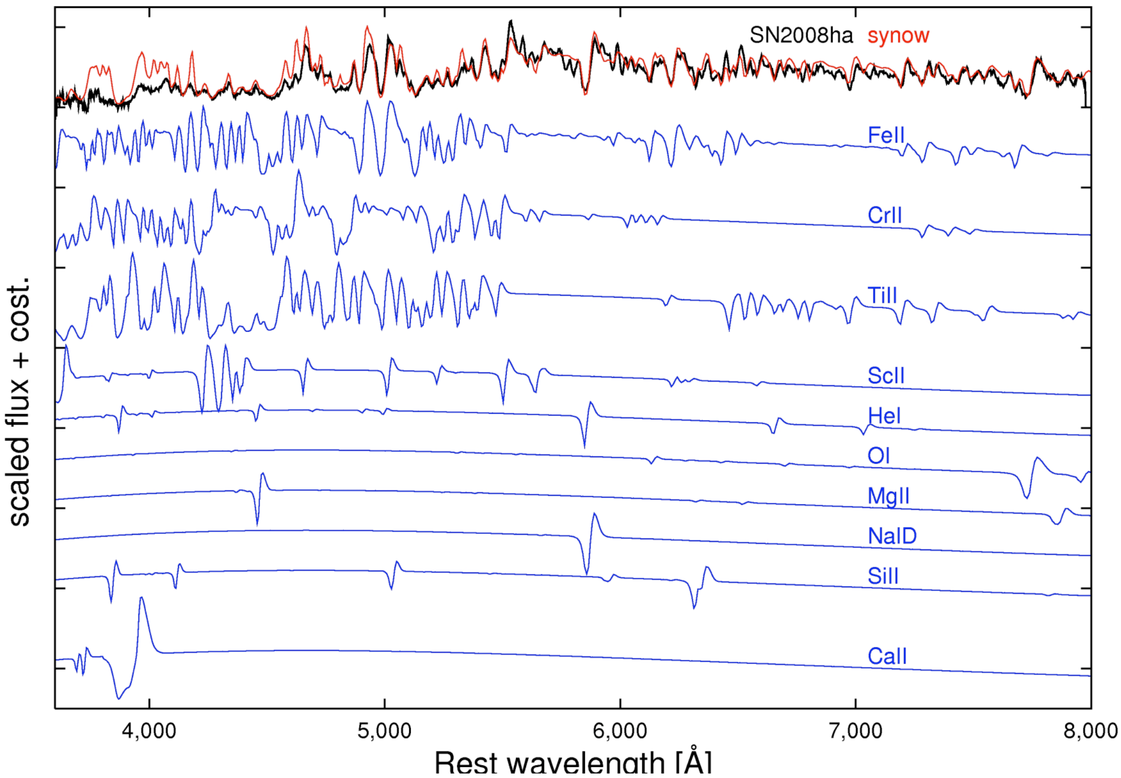
The image of the host galaxy of SN2007qd SDSSJ020932.74-005959.6 is shown on the left, with the position of the SN marked by cross-hairs. The host is a spiral at $z = 0.043$, with a bar oriented east-west (SBb or SBc). The host galaxy of SN2002cx (CGCG 044-035), is shown on the right. A high resolution HST WFPC2 archive image of CGCG 044-035 clearly shows it to be an inclined Sb/Sc galaxy with well defined spiral structure.



Supplementary Figure 2| Host galaxies of SN2002cx-like events. The distribution of the host-galaxy morphology of 2002cx-like events (red) is compared with those of under luminous and normal thermonuclear supernovae, H-rich core-collapse supernovae and H-poor core-collapse supernovae (blue). Information on the host galaxies of 2002cx-like events is reported in Table 2 of Supplementary Information, while the data of the hosts of other supernovae are from the Asiago catalogue (http://web.oapd.inaf.it/supern/cat/). SN2002cx-like events occur mainly in late-type galaxies, (Sb or later), while under-luminous and normal SNe Ia occur also in early-type galaxies. In particular, under-luminous SNe Ia, those that share with SN2002cx-like events some similarity in the peak luminosity, occur mainly in S0 or earlier.



Supplementary Figure 3| Spectroscopic comparison between SN2008ha and SN2007gr. The spectra of SN2008ha are compared with those of the type Ic SN2007gr at similar epochs. The spectra of SN2007gr are shifted to longer wavelengths by 3000 km s^{-1} in order to account for the different photospheric velocities. All major features of SN2007gr appear also in the spectra of SN2008ha, but with narrower profiles. This comparison shows that, during the photospheric phase, the intermediate-mass elements~~,~~ identified in SN2008ha, are common also in other core-collapse SNe.



Supplementary Figure 4| Line identification in SN2008ha. The narrow spectral lines give us the possibility to identify the ions in the early spectrum of SN2008ha. Using Synow (Ref. 43), a spectrum synthesis code particularly suited for line identification, we obtain a good fit to the SN2008ha spectrum at 13 days after maximum using the following parameters: a continuum blackbody temperature of Tbb = 6,200° K, a photospheric velocity v=1,300 km s^{-1}, a power-law index for the radial density profile of n = 6 and an excitation temperature of individual ions in the range 5,000-6,000° K for neutral ions and 8,000-10,000 for single ionized species. We were able to reproduce the observed spectrum reasonably well using 10 species (Fe II, Ti II, Cr II, O I, He I, Si II, Sc II, Mg II, Na I, Ca II). Fe II, Ti II and Cr II produce most of the observed lines in the spectrum, while other ions were included to improve the fit. Vice versa, including S II did not improve the fit. Detailed spectral modelling is needed to confirm the line identification and derive element abundances.

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